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U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

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TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/868861

INTERNATIONAL APPLICATION NO.  
PCT/JP00/07424INTERNATIONAL FILING DATE  
October 24, 2000PRIORITY DATE CLAIMED  
October 29, 1999

## TITLE OF INVENTION

## BASE STATION APPARATUS AND TRANSMIT POWER CONTROL METHOD

## APPLICANT(S) FOR DO/EO/US

Hideki KANEMOTO

Osamu KATO

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1.  This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2.  This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3.  This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4.  The US has been elected by the expiration of 19 months from the priority date (Article 31).
5.  A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
  - a.  is attached hereto (required only if not communicated by the International Bureau).
  - b.  has been communicated by the International Bureau.
  - c.  is not required, as the application was filed in the United States Receiving Office (RO/US).
6.  An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
  - a.  is attached hereto.
  - b.  has been previously submitted under 35 U.S.C. 154(d)(4).
7.  Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
  - a.  are attached hereto (required only if not communicated by the International Bureau).
  - b.  have been communicated by the International Bureau.
  - c.  have not been made; however, the time limit for making such amendments has NOT expired.
  - d.  have not been made and will not be made.
8.  An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9.  An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10.  An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11.  A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12.  A copy of the International Search Report (PCT/ISA/210).

## Items 13 to 20 below concern document(s) or information included:

13.  An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14.  An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15.  A **FIRST** preliminary amendment.
16.  A **SECOND** or **SUBSEQUENT** preliminary amendment.
17.  A substitute specification.
18.  A change of power of attorney and/or address letter.
19.  A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20.  A second copy of the published international application under 35 U.S.C. 154(d)(4).
21.  A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22.  Certificate of Mailing by Express Mail
23.  Other items or information:

Claim for Priority with PCT/IB/304

PCT/IB/308

PCT/RO/101

U.S. APPLICATION NO. (UNKNOWN SEE 37 CFR <b>09786861</b>	INTERNATIONAL APPLICATION NO. <b>PCT/JP00/07424</b>	ATTORNEY'S DOCKET NUMBER <b>L9289.01150</b>																				
<p>24. The following fees are submitted:</p> <p><b>BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5) ) :</b></p> <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%; vertical-align: top;"> <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... <b>\$1000.00</b></td> <td style="width: 30%; vertical-align: top; text-align: right;"><b>CALCULATIONS PTO USE ONLY</b></td> </tr> <tr> <td><input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... <b>\$860.00</b></td> <td></td> </tr> <tr> <td><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$710.00</b></td> <td></td> </tr> <tr> <td><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... <b>\$690.00</b></td> <td></td> </tr> <tr> <td><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... <b>\$100.00</b></td> <td></td> </tr> </table> <p style="text-align: center;"><b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b> <b>\$860.00</b></p>		<input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... <b>\$1000.00</b>	<b>CALCULATIONS PTO USE ONLY</b>	<input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... <b>\$860.00</b>		<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$710.00</b>		<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... <b>\$690.00</b>		<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... <b>\$100.00</b>												
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<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">CLAIMS</th> <th style="width: 25%;">NUMBER FILED</th> <th style="width: 20%;">NUMBER EXTRA</th> <th style="width: 20%;">RATE</th> <th style="width: 20%;"> </th> </tr> </thead> <tbody> <tr> <td>Total claims</td> <td>11 - 20 =</td> <td>0</td> <td>x \$18.00</td> <td><b>\$0.00</b></td> </tr> <tr> <td>Independent claims</td> <td>4 - 3 =</td> <td>1</td> <td>x \$80.00</td> <td><b>\$80.00</b></td> </tr> <tr> <td colspan="3">Multiple Dependent Claims (check if applicable).</td> <td style="text-align: center;"><input type="checkbox"/></td> <td><b>\$0.00</b></td> </tr> </tbody> </table>		CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		Total claims	11 - 20 =	0	x \$18.00	<b>\$0.00</b>	Independent claims	4 - 3 =	1	x \$80.00	<b>\$80.00</b>	Multiple Dependent Claims (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>	<b>TOTAL OF ABOVE CALCULATIONS =</b> <b>\$940.00</b>
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<input type="checkbox"/> <b>TOTAL FEES ENCLOSED =</b>		<b>\$980.00</b>																				
		<b>Amount to be:</b> refunded    \$																				
		charged    \$																				

a.  A check in the amount of **\$980.00** to cover the above fees is enclosed.  
 b.  Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.  
 c. The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **19-4375** A duplicate copy of this sheet is enclosed.  
 d.  Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

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June 21, 2001  
DATE

## DESCRIPTION

## BASE STATION APPARATUS AND TRANSMIT POWER CONTROL METHOD

## 5 Technical Field

The present invention relates to a base station apparatus and transmit power control method used in a mobile radio communication system such as a cellular telephone and automobile telephone.

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## Background Art

FIG.1 is a drawing to outline handover that takes place in a mobile radio communication cellular system. In FIG.1, mobile station 11 is currently carrying out radio communication with base station 31 installed in cell 21 and moving toward cell 22 adjacent to cell 21.

When mobile station 11 moves from cell 21 to cell 22, mobile station 11 carries out diversity handover between base station 31 and base station 32. During the diversity handover, mobile station 11 measures the reception quality of a common control channel by communicating with both base station 31 and base station 32. Then, when the reception quality of base station 32 becomes better than that of base station 31, mobile station 11 switches its communication counterpart from base station 31 to base station 32.

Furthermore, during the diversity handover, control station 41 selects and combines signals with good

CROSS-REFERENCED PATENTS

reception conditions from among signals sent from mobile station 11 and received by base station 31 and base station 32.

Here, in a cellular system, closed-loop transmit power control is performed between the mobile station and base stations to improve the frequency utilization efficiency by reducing interference with other communication stations. Transmit power control by the base stations is carried out by referring to the reception quality such as a reception SIR (signal to interference ratio) and the error rate of the signal sent from the mobile station, generating information to control the transmit power of the mobile station (Transmit Power Control: hereinafter referred to as "TPC") so that the reception quality satisfies a certain standard and sending the TPC to the mobile station.

Transmit power control using the reception SIR by the base stations is carried out by receiving an individual channel sent from the mobile station subject to the transmit power control and calculating the ratio of the power of the desired signal to the other reception power, that is, the power of the interference signal.

It is a general practice that an average power value over several slots or frames instead of an instantaneous value is used as the interference signal power value and this is disclosed in the Unexamined Japanese Patent Publication No. HEI 10-13364.

During diversity handover, transmit power control

is performed simultaneously between mobile station 11 and base stations 31 and 32, and mobile station 11 acquires TPCs sent from base stations 31 and 32 and carries out transmit power control of the own station based on those 5 TPCs.

Since the reception signals of base stations 31 and 32 are selected and combined by control station 41, not all base stations in communication need to satisfy the reception quality standard and mobile station 11 10 determines transmit power according to the TPC with minimum transmit signal power of a plurality of TPCs received.

However, when diversity handover starts, that is, when the mobile station starts communication with a new 15 base station in addition to the base station currently in communication, the base station that newly enters into communication has no sufficiently observed individual channels, which are to be used for measurement of the SIR of the mobile station and to be averaged, and therefore 20 averaging causes the power of the signal of interference with the mobile station to be measured lower than the actual value.

Therefore, the base station that has newly entered 25 into communication determines that the reception SIR of the mobile station is satisfactory and transmits a TPC instructing the mobile station to reduce its transmit power.

Even if the mobile station receives from the base

station currently in communication a TPC instructing that the transmit power should be increased, the mobile station receives from the base station that has newly entered into communication the TPC instructing that the transmit power should be reduced, and therefore the mobile station reduces transmit power according to the TPC instructing the minimum transmit signal power even if the reception SIR is actually not satisfactory for the base station currently in communication.

10        For this reason, the reception quality further deteriorates and satisfactory reception quality is not obtained from either of the base stations involved in the diversity handover, which prevents the control station from combining the reception signals. As a result, 15        it will be necessary to retransmit the transmission unit, causing problems of reducing the communication efficiency and interrupting radio connections.

#### Disclosure of Invention

20        It is an object of the present invention to provide a base station apparatus and transmit power control method capable of constantly receiving signals of sufficient quality and performing efficient communication during handover.

25        This object is achieved, when transmit power control is performed with a mobile station with which a radio connection has been newly established, by not performing control to reduce transmit power on the relevant mobile

station until the power of the interference signal against the signal sent from the relevant mobile station can be measured appropriately.

## 5 Brief Description of Drawings

FIG.1 is a drawing to outline handover in a mobile radio communication cellular system;

FIG.2 is a block diagram showing a configuration of a base station according to Embodiment 1 of the present

10 invention;

FIG.3 is a flow chart showing a TPC creation method based on a reception SIR of the base station according to Embodiment 1 of the present invention;

FIG.4 is a block diagram showing a configuration 15 of a base station according to Embodiment 2 of the present invention; and

FIG.5 is a flow chart showing a TPC creation method based on a reception SIR of the base station according to Embodiment 2 of the present invention.

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## Best Mode for Carrying out the Invention

With reference now to the attached drawings, embodiments of the present invention will be explained 25 in detail below.

(Embodiment 1)

FIG.2 is a block diagram showing a configuration

of a base station according to Embodiment 1 of the present invention.

A signal sent from a mobile station with which the base station is communicating is received by antenna 101 and input to radio reception section 103 via transmission/reception separation section 102. Radio reception section 103 performs radio processing such as amplification and frequency conversion on the reception signal input. Despreading section 104 multiplies the output signal from radio reception section 103 by a spreading code specific to each mobile station.

Maximum ratio combination section 105 combines the output signal from despreading section 104 at a maximum ratio. Demodulation section 106 demodulates the output signal of maximum ratio combination section 105 and extracts the reception data.

Reception SIR calculation section 107 measures the desired signal power and interference signal power from the output signal of despreading section 104, calculates an average value of new interference signal power using the average value of the interference signal power stored so far in power value storage section 108 and calculates a reception SIR from the ratio of the desired signal power to interference signal power. Specific examples of measurements of the desired signal power, interference signal power and averaging thereof will be described later.

Power value storage section 108 stores the count

D E S C R I P T I O N

of interference signal power measured so far by reception SIR calculation section 107 and the average value of the interference signal power calculated by reception SIR calculation section 107.

5 Reference value decision section 109 decides whether the reception SIR calculated by reception SIR calculation section 107 is greater than a reference value or not and notifies TPC creation section 110 of the decision result.

10 When the count of the interference signal power stored in power value storage section 108 is smaller than the count necessary to perform averaging processing in reception SIR calculation section 107 (hereinafter referred to as "averaging count"), that is, until the 15 interference signal power against the signal sent from the relevant mobile station can be correctly estimated, TPC creation section 110 creates a TPC instructing an increase of transmit power irrespective of the decision result notified from reference value decision section 20 109. Furthermore, when the count of the interference signal power stored in power value storage section 108 satisfies the averaging count, TPC creation section 110 creates a TPC instructing a decrease of transmit power in the case where the reception SIR is greater than the 25 reference value and creates a TPC instructing an increase of transmit power in the case where the reception SIR is equal to or smaller than the reference value based on the decision result notified from reference value

decision section 109.

Combination section 111 combines the TPCs output from TPC creation section 110 with transmission data and forms a frame according to a transmission data format.

5 Modulation section 112 performs primary modulation processing such as PSK and QPSK on the output signal of combination section 111. Spreading section 113 multiplies the output signal of modulation section 112 by a specific spreading code. Radio transmission section 10 114 performs radio processing such as amplification and frequency conversion on the output signal of spreading section 113 and transmits the signal from antenna 101 via transmission/reception separation section 102.

15 The mobile station that has received the signal carrying TPC from the base station increases the transmit power value by a predetermined quantity (e.g., 1 dB) from the previous transmit power value if the extracted TPC instructs an increase of transmit power and decreases the transmit power value by a predetermined quantity (e.g., 20 1 dB) from the previous transmit power value if the extracted TPC instructs a decrease of transmit power.

25 Then, specific examples of measurements of desired signal power and interference signal power of reception SIR calculation section 107 and averaging thereof will be explained.

First, reception SIR calculation section 107 detects and extracts the positions of pilot symbols in a reception slot, that is, known symbols and corrects

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the quadrant of the despread value, that is, removes the modulated components of 0 or 1.

Then, reception SIR calculation section 107 calculates desired signal power RSSI and interference 5 signal power ISSI in the actual slot as follows.

With respect to the  $p$ th path in a  $P$  path, average value  $rssi[p].i$  of an in-phase component and average value  $rssi[p].q$  of a quadrature component for every slot in  $N$  pilot symbols after quadrant correction are calculated 10 from following expressions (1).

$$rssi[p].i = \frac{1}{N} \sum_{n=1}^N Sx[n][p].i$$

$$rssi[p].q = \frac{1}{N} \sum_{n=1}^N Sx[n][p].q \quad \dots(1)$$

Then, desired signal power  $rssi[p]$  for every slot and every path is calculated from following expression 15 (2).

$$rssi[p] = rssi[p].i^2 + rssi[p].q^2 \quad \dots(2)$$

Overall desired signal power RSSI is calculated from following expression (3) as a sum of desired signal power for every path.

$$20 \quad RSSI = \sum_{p=1}^P rssi[p] \quad \dots(3)$$

The in-phase component  $issi[n][p].i$  and quadrature component  $issi[n][p].q$  of the interference signal are calculated from following expressions (4) from a difference between pilot symbols after a quadrant

correction and its average for every slot.

$$issi[n][p].i = Sx[n][p].i - rssi[p].i$$

$$issi[n][p].q = Sx[n][p].q - rssi[p].q \quad \dots(4)$$

From this, interference signal power  $issi[p]$  for  
5 every slot and every path is calculated from following  
expression (5).

$$issi[p] = \frac{1}{N} \sum_{n=1}^N (issi[n][p].i^2 + issi[n][p].q^2) \quad \dots(5)$$

Then, overall interference signal power ISSI is  
calculated as an average value for every path from  
10 following expression (6).

$$ISSI = \frac{1}{P} \sum_{p=1}^P issi[p] \quad \dots(6)$$

Then, reception SIR calculation section 107  
averages interference signal power ISSI over a plurality  
of slots using an IIR filter as shown in following  
15 expression (7).

$$ISSI_{ave} = \alpha \cdot ISSI_{ave\_previous} + (1 - \alpha) \cdot ISSI \quad \dots(7)$$

Here,  $ISSI_{ave\_previous}$  is the averaging interference  
signal power calculated in the immediately preceding slot  
and  $\alpha$  is called a "forgetting factor" and a value such  
20 as 0.99 is set. In this case, weight 1-0.99, that is,  
0.01 is assigned to the interference signal power ISSI  
calculated in the current slot and since it is very small  
compared to the weight 0.99 related to the averaged  
interference signal power  $ISSI_{ave\_previous}$  calculated in the  
25 previous slot, it is not until measurement and averaging

have been performed approximately 100 times that reliable averaging interference signal power is measured.

Then, the TPC creation method based on the reception SIR of the base station shown in FIG.2 will be explained  
5 using the flow chart in FIG.3.

First, in step (hereinafter abbreviated as "ST")  
201, reception SIR calculation section 107 calculates a reception SIR based on the measured desired signal power and interference signal power, and the averaged value  
10 of the interference signal power stored in power value storage section 108.

Then, in ST202, TPC creation section 110 decides whether the count of interference signal power stored in power value storage section 108 satisfies the averaging  
15 count or not.

In the case where the count of interference signal power satisfies the averaging count in ST202, reference value decision section 109 compares the level of the reception SIR with a predetermined reference value in  
20 ST203.

Then, in the case where the count of interference signal power does not satisfy the averaging count in ST202 or the reception SIR is equal to or smaller than the reference value in ST203, TPC creation section 110 creates  
25 a TPC to instruct an increase of transmit power in ST204.

On the other hand, in the case where the reception SIR is greater than the reference value in ST203, TPC creation section 110 creates a TPC to instruct a decrease

of transmit power in ST205.

In this way, the base station instructs a mobile station with which to establish a new radio link to increase transmit power irrespective of the calculated reception 5 SIR until the base station can correctly estimate the interference signal power against a signal sent from the relevant mobile station, thus preventing the base station from instructing a decrease of transmit power by overestimating the reception SIR, and thereby allowing 10 the base station to always receive signals of sufficient quality and perform efficient communications.

Moreover, after successful estimation of the interference signal power against the signal sent from the mobile station with which a new radio connection has 15 been established, the base station can perform correct transmit power control on the relevant mobile station.

(Embodiment 2)

FIG.4 is a block diagram showing a configuration 20 of a base station according to Embodiment 2 of the present invention. In the base station shown in FIG.4, the parts having a configuration and operation common to those of the base station according to Embodiment 1 shown in FIG.2 are assigned the same reference numerals as those in FIG.2 25 and explanations thereof are omitted.

The base station shown in FIG.4 has a configuration with TPC storage section 301 added to the base station shown in FIG.2.

TPC storage section 301 stores only one TPC input from TPC creation section 110 and updates the storage content every time a TPC is input. That is, TPC storage section 301 stores only the previous TPC.

5       TPC creation section 110 outputs the created TPC to the combination section 111 and TPC storage section 301. Furthermore, when the count of the interference signal power stored in power value storage section 108 is smaller than the averaging count, TPC creation section  
10      110 reads the previous TPC stored in TPC storage section 301 and creates a TPC whose content is opposite to that of the previous TPC.

Then, the TPC creation method based on the reception SIR of the base station shown in FIG.4 will be explained  
15      using the flow chart in FIG.5.

First in ST401, reception SIR calculation section 107 calculates a reception SIR based on the measured desired signal power and interference signal power, and the average value of interference signal power stored  
20      in power value storage section 108.

Then, in ST402, TPC creation section 110 decides whether the count of interference signal power stored in power value storage section 108 satisfies the averaging count or not.

25      In the case where the count of desired signal power satisfies the averaging count in ST402, reference value decision section 109 compares the level of the reception SIR with a preset reference value in ST403.

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On the other hand, in the case where the count of interference signal power does not satisfy the averaging count in ST402, TPC creation section 110 decides the content of the previous TPC stored in TPC storage section 5 301 in ST404.

In the case where the reception SIR is equal to or smaller than the reference value in ST403 or the content of the previous TPC instructs a decrease of transmit power in ST404, TPC creation section 110 creates a TPC 10 instructing an increase of transmit power in ST405.

On the other hand, in the case where the reception SIR is greater than the reference value in ST403 or the content of the previous TPC instructs an increase of transmit power in ST404, TPC creation section 110 creates 15 a TPC instructing a decrease of transmit power in ST406.

Thus, in the case where the measured count of interference signal power does not satisfy the count necessary for averaging, this embodiment creates a TPC taking into account the previously created TPC and the 20 mobile station continues to increase transmit power in addition to the effect of Embodiment 1, and can thereby prevent interference from other mobile stations from increasing.

By the way, Embodiment 2 above describes the case 25 where the measured count of interference signal power does not satisfy the count necessary for averaging or an increase and decrease of transmit power are instructed alternately, but the present invention is not limited

to this and can be implemented as far as the rate of instructing an increase of transmit power does not fall below the rate of instructing a decrease of transmit power, for example, instructing a decrease of transmit power 5 after instructing an increase of transmit power two consecutive times.

Furthermore, the embodiments above can also be configured in such a way that measurement of interference signal power is started for a mobile station with which 10 to establish a new radio connection. In this case, correct transmit power control can be performed on the mobile station when the connection is established.

Furthermore, the reception SIR calculation system of the present invention is not necessarily limited to 15 a system of averaging over several immediately preceding consecutive slot times. That is, the present invention can produce effects similar to those of the embodiments above by some time averaging over several slots, which may not be several immediately preceding slots or may 20 be several non-consecutive slots, if the reception SIR calculation system is at least a system of calculating a more accurate reception SIR.

As is apparent from the explanations above, the base station apparatus and transmit power control method of 25 the present invention can perform transmit power control so that the transmit power of the relevant mobile station does not decrease during handover until interference signal power is correctly measured, allowing the base

0 2 0 6 0 8 0 4 0 1 0 4

station to constantly receive signals of sufficient quality, and realize efficient communications.

This application is based on the Japanese Patent 5 Application No. HEI 11-308077 filed on October 29, 1999, entire content of which is expressly incorporated by reference herein.

#### Industrial Applicability

10 The present invention is ideally applicable to a mobile radio communication system such as a cellular telephone and automobile telephone.

0926684.0224.02

What is claimed is:

1. A base station apparatus comprising:

reception SIR calculating means for calculating a  
5 signal to interference ratio using a value obtained by  
averaging interference signal power for several slot  
times;

10 reference value deciding means for deciding whether  
the calculated signal to interference ratio is greater  
than a reference value or not; and

15 TPC creating means for creating transmit power  
control information to instruct either an increase or  
decrease of transmit power based on the number of slots  
used to calculate interference signal power by averaging  
and the decision result of said reference value deciding  
means.

2. The base station apparatus according to claim 1, wherein  
when the number of slots used to calculate interference  
20 signal power by averaging falls short of a predetermined  
number, the TPC creating means creates transmit power  
control information instructing an increase of transmit  
power.

25 3. The base station apparatus according to claim 1, wherein  
when the number of slots used to calculate interference  
signal power by averaging falls short of a predetermined  
number, the TPC creating means creates transmit power

0 9 6 8 6 5 1 0 6 2 4 0 6

control information so that the count of transmit power control information instructing an increase of transmit power created so far does not fall below the count of transmit power control information instructing a decrease 5 of transmit power.

4. The base station apparatus according to claim 1, wherein when the number of slots used to calculate interference signal power by averaging falls short of a predetermined 10 number, the TPC creating means creates transmit power control information whose content is opposite to that of the immediately preceding transmit power control information.

15 5. The base station apparatus according to claim 1, wherein when the number of slots used to calculate interference signal power by averaging satisfies a predetermined number, the TPC creating means creates transmit power control information instructing a decrease of transmit power when the signal to interference ratio is greater 20 than a reference value and creates transmit power control information instructing an increase of transmit power when the signal to interference ratio is equal to or smaller than the reference value.

25

6. The base station apparatus according to claim 1, wherein the reception SIR calculating means starts to measure interference signal power for a communication terminal

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apparatus with which to establish a new radio connection prior to starting control of uplink transmit power of the communication terminal apparatus based on the transmit power control information inserted into the 5 downlink.

7. A communication terminal apparatus that carries out radio communication with the base station apparatus according to claim 1 and controls transmit power based 10 on transmit power control information sent from said base station apparatus.

8. A transmit power control method for creating transmit power control information instructing an increase of 15 transmit power until a base station apparatus can correctly estimate interference signal power against a signal sent from a communication terminal apparatus with which a new radio connection has been established.

20 9. A transmit power control method for creating transmit power control information so that the count of transmit power control information instructing an increase of transmit power created so far does not fall below the count of transmit power control information instructing 25 a decrease of transmit power until a base station apparatus can correctly estimate interference signal power against a signal sent from a communication terminal apparatus with which a new radio connection has been established.

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10. A transmit power control method for creating transmit power control information whose content is opposite to that of the immediately preceding transmit power control information until a base station apparatus can correctly estimate interference signal power against a signal sent from a communication terminal apparatus with which a new radio connection has been established.
- 5
- 10 11. The transmit power control method according to claim 8, wherein the base station apparatus starts to measure interference signal power in advance for a communication terminal apparatus with which to establish a new radio connection.

## ABSTRACT

Reception SIR calculation section 107 calculates a reception SIR using a value obtained by averaging 5 interference signal power over several immediately preceding consecutive slots. Reference value decision section 109 decides whether the reception SIR is greater than a reference value or not. In the case where the count of desired signal power stored in power value storage 10 section 108 satisfies a count necessary for averaging and at the same time the reception SIR is not greater than the reference value, TPC creation section 110 creates a TPC to instruct a decrease of transmit power and creates a TPC to instruct an increase of transmit power otherwise. 15 This allows the base station to constantly receive signals of sufficient quality and perform efficient communications.

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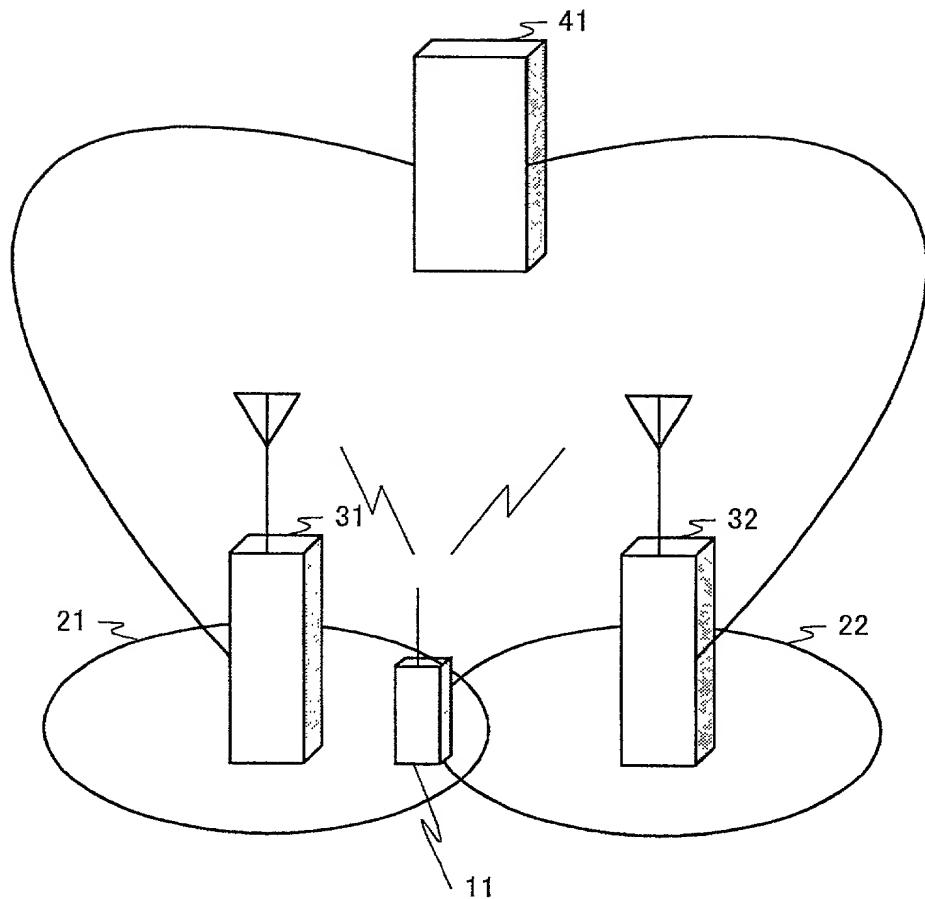


FIG. 1

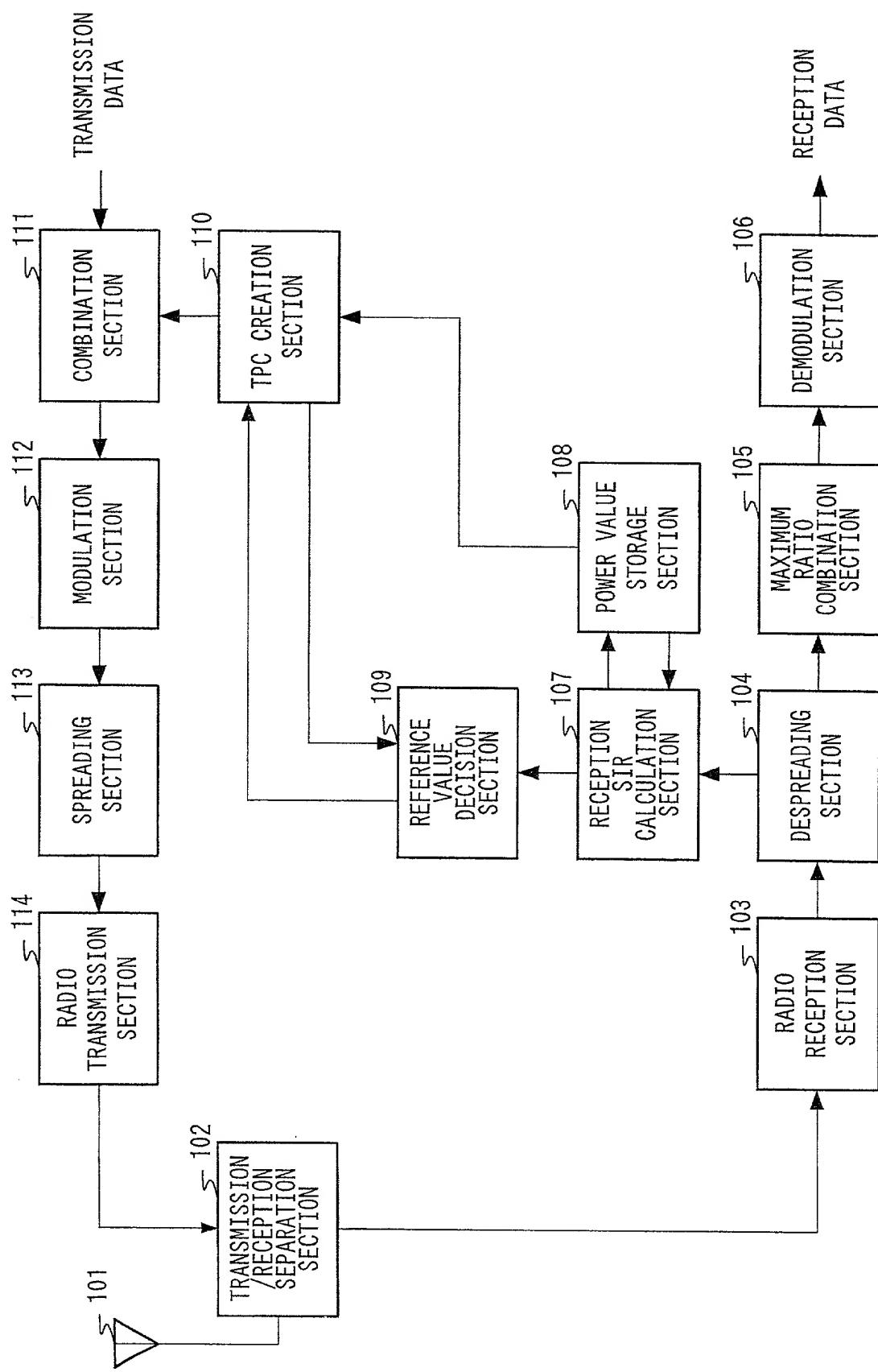


FIG. 2

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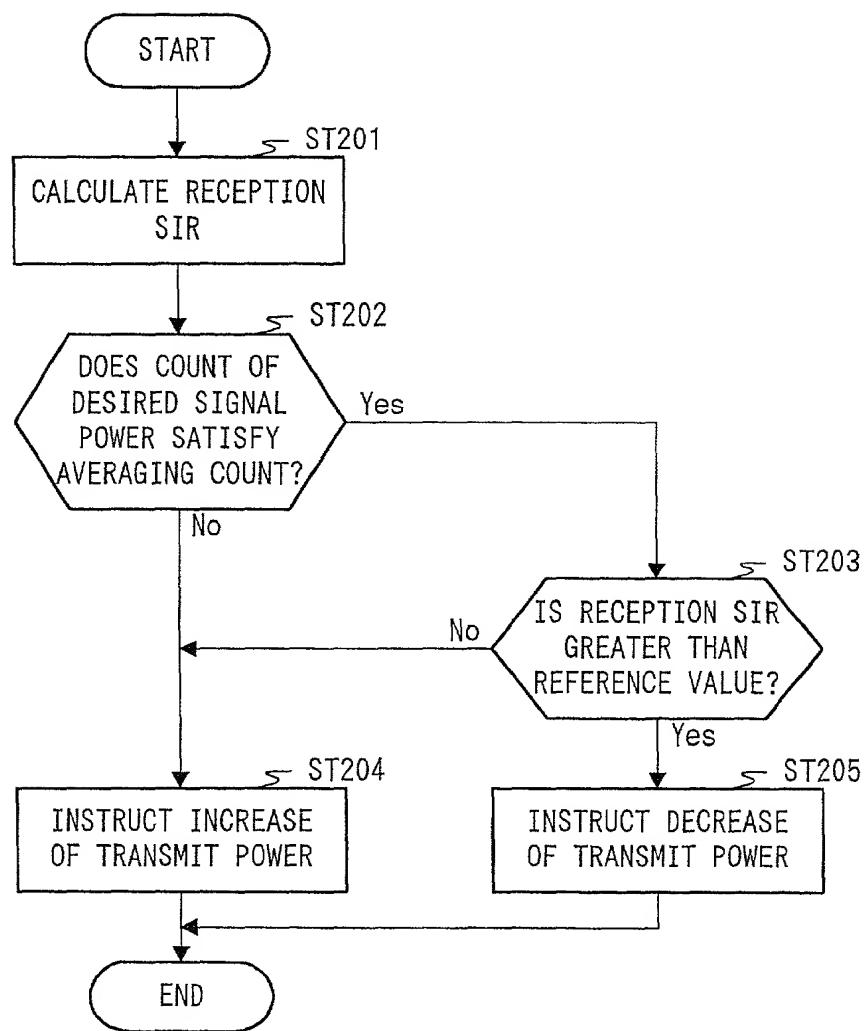


FIG. 3

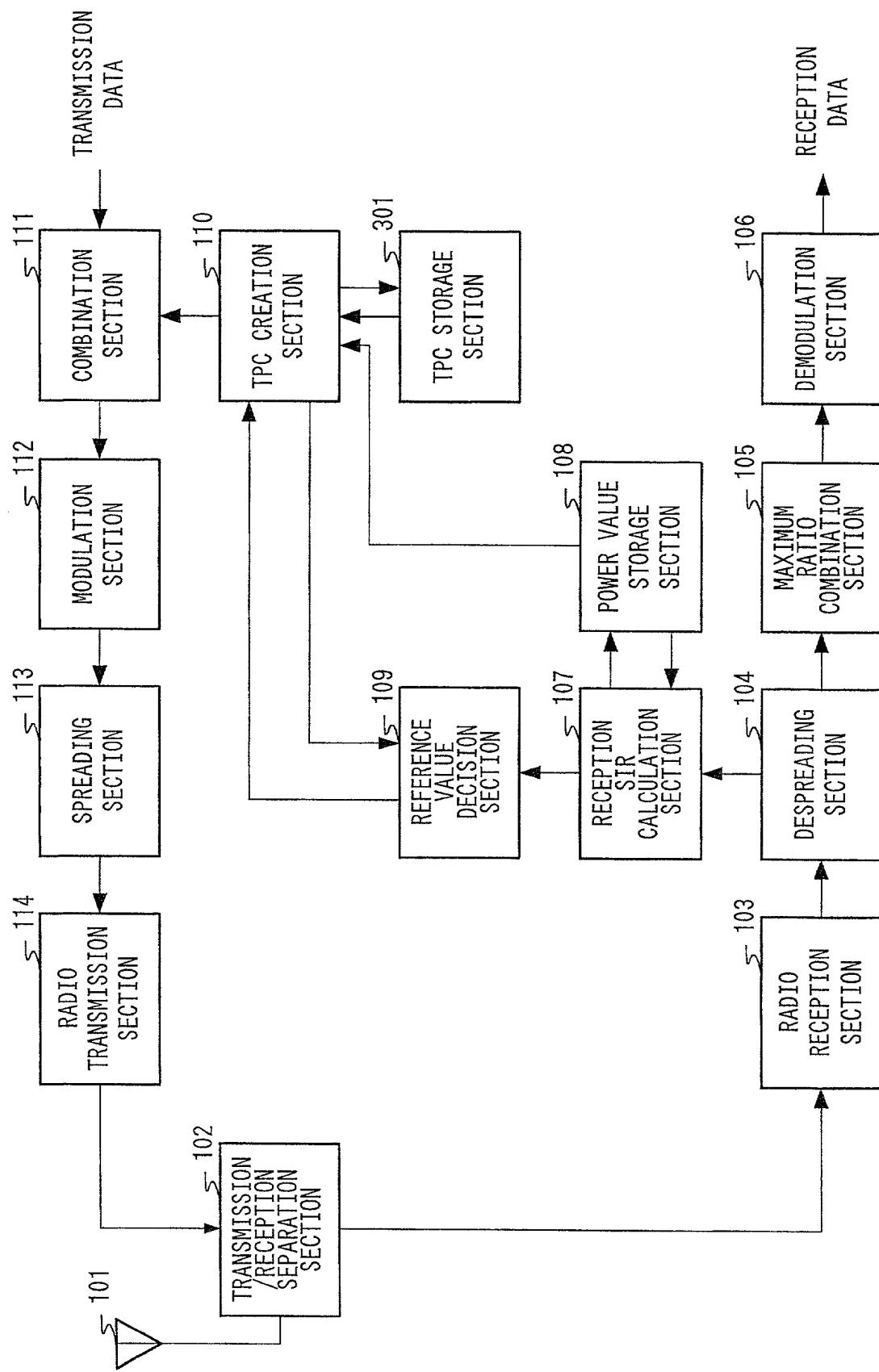


FIG. 4

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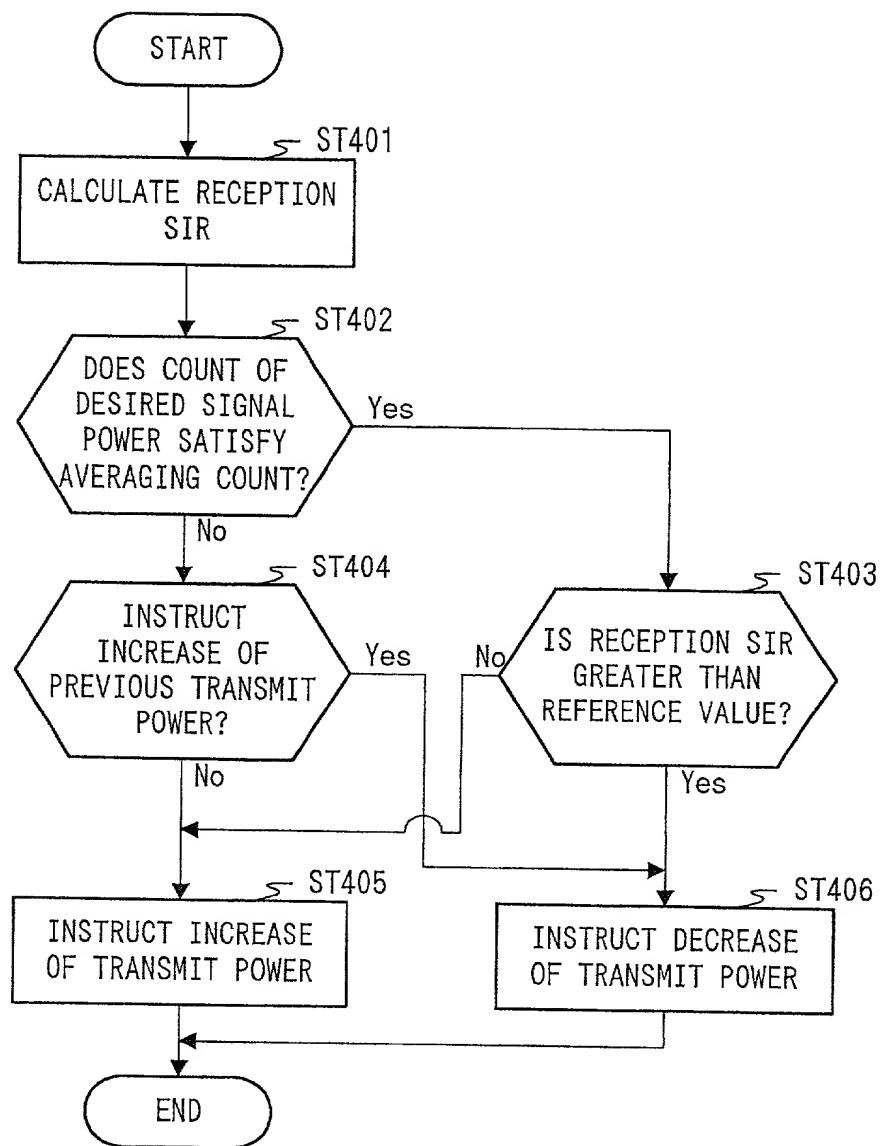


FIG. 5

**APPLICATION FOR UNITED STATES PATENT**  
**Declaration for Patent Application**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on

the invention entitled: BASE STATION APPARATUS AND TRANSMIT POWER CONTROL METHOD

the specification of which 2 (file no \_\_\_\_\_)

(check at least one)

3 [  ] is attached hereto  
 4 [  ] was filed on \_\_\_\_\_ as (5) U.S. Application Serial No. \_\_\_\_\_  
 6 [  ] and was amended \_\_\_\_\_  
 (if applicable)

7 [  ] was filed as PCT international application

Use this portion only if you are entering the U.S. National phase based on a PCT International Application designating the U.S.

8 Number PCT/JP00/07424  
 9 on October 24, 2000  
 and was amended under PCT Article(s) 19 and/or 34  
 10 on \_\_\_\_\_ (if applicable).  
 11 priority date claimed in PCT International Application  
JAPAN JP11-308077 29/October/1999  
 (Country) (Number) (Day/Month/Year Filed)

I hereby declare that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended, by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me which is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application (s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date earlier than that of the application(s) on which priority is claimed.

Prior (Foreign) Application(s) any Priority Claims Under 35 U.S.C. 119 Priority Claimed

12a \_\_\_\_\_  
 (Country) \_\_\_\_\_ (Number) \_\_\_\_\_ (Day/Month/Year Filed) [  ] [  ]  
 Yes No

\_\_\_\_\_  
 (Country) \_\_\_\_\_ (Number) \_\_\_\_\_ (Day/Month/Year Filed) [  ] [  ]  
 Yes No

Priority Claim(s) from U.S. Provisional Application(s) – I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

12b \_\_\_\_\_ Application No. \_\_\_\_\_ Day/Month/Year Filed \_\_\_\_\_ Application No. \_\_\_\_\_ Day/Month/Year Filed \_\_\_\_\_

Do not use this portion to identify a PCT application if the parent application is the U.S. National phase of the PCT application

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between filing date of the prior application and the national or PCT international filing date of this application.

13 \_\_\_\_\_ (U.S. Application Number) \_\_\_\_\_ (U.S. Filing Date) \_\_\_\_\_ Status (patented, pending, abandoned)

I hereby appoint the following attorneys of the firm of Stevens, Davis, Miller & Mosher, L.L.P. as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent and Trademark Office:

3 James E. Ledbetter, Reg. No. 28732; Thomas P. Pavelko, Reg. No. 31689; and Anthony P. Venturino, Reg. No. 31674.

**ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO  
 STEVENS, DAVIS, MILLER & MOSHER, L.L.P., 1615 L Street, N.W., Suite 850, Washington, D.C. 20036,  
 TELEPHONE (202) 408-5100, FACSIMILE (202) 408-5200.**

See page 2 for signature lines

## INSTRUCTIONS FOR COMPLETION OF THIS FORM

line 1 Insert the same title as is used on the specification and in the assignment.

line 2 Is optional but is provided so that you can use it to identify more readily an application prior to the time that the Patent Office application serial number is assigned. We suggest that the specification, drawings and declaration always bear a file number since it can help to get the papers together in case they become inadvertently separated. In instances where the specification is filed without a signed declaration form (under 37 CFR §1.53) a file number on a later-received separate form will assist us in associating it with the correct case.

line 3 Check this box if the specification, claims and drawing (if any) are attached to this declaration form, e.g., when filing a new patent application.

lines 4-5 Are only used in an instance where the application is already on file and the declaration form is being separately filed, e.g., when the application was originally filed without a signed declaration or where the Patent Office has required a new declaration because of a deficiency in the original declaration. In such an instance the Patent Office will require that lines 4 and 5 be completed with the filing date and application serial number already assigned.

line 6 Is used in conjunction with line 5 but only when there have been one or more amendments to the specification or claims. Line 6 is also used when the Examiner requires a new declaration because claims inserted by amendment cover subject matter not originally claimed (37 CFR §1.67).

lines 7-11 Are for PCT (Patent Cooperation Treaty) cases and are used only when you are entering the U.S. National phase (Chapter I or II) based upon a previously filed PCT International application designating the U.S.

line 7 Check this box if this is a PCT National Phase application.

line 8 Insert PCT International application number.

line 9 Insert date of filing of PCT International application.

lines 10-11 Insert the date of all amendments filed in the PCT International application. Such amendments are optional, so this line at times will not be used.

line 12a Is used in the following instances:

(i) If a single priority is being claimed from a foreign application you need to list only the first-filed application; you do not need to list other countries if all applications were filed within one year of the U.S. filing.

(ii) If multiple priorities are being claimed, from a plurality of applications filed in one or more countries, you must list the first filed application for each aspect of the invention. Example: if aspect A of the invention was disclosed in an application filed 11 months earlier in country X and aspect B was disclosed 9 months earlier in an application filed in country Y, then the applications in both countries X and Y must be identified. Only the first application for each aspect of the invention needs to be identified provided all applications on that aspect were filed within one year prior to the U.S. filing.

(iii) If a non-priority application is being filed you must list all applications in all countries where corresponding foreign applications were filed more than one year prior to the U.S. filing. This is so the Examiner can check to see if any of those applications were published or patented early enough to be prior art against the U.S. application.

(iv) If there are more than two applications to be listed we suggest that you type in on this form only "See attached Schedule A" and then list all of the previous applications on an attached sheet.

line 12b Is used to claim priority under 35 USC §119(e) based on a provisional application filed within one year of the filing of the instant application. More than one provisional application may be identified provided neither was filed more than one year earlier.

line 13 This block is used only in instances where there is a previously filed U.S. non-provisional application which was copending at the time the present application was (or is being) filed. That previous application could be a U.S. non-provisional application or the National Phase of a PCT allocation. In such a case the present application may be entitled to the priority of the previous application's U.S. filing date (and consequently the foreign priority thereof) provided the present application is identified as a continuing application (continuation, divisional or continuation-in-part) of the earlier (parent) application. If the foregoing is applicable, please fill in one line for each such prior application.

line 14 Type the inventor's proper legal name in the order specified, e.g., "John B. JONES" or "J. Bob JONES" if the inventor so prefers. It is not acceptable to use only initials such as "J. B. JONES."

line 15 The inventor's "signature" may be his (or her) usual manner of signing but it is preferable that the inventor simply write his (or her) name in his (or her) own cursive handwriting in the same order as on line 14, e.g., given name, middle initial and Family name.

line 16 Insert the actual date of signature.

line 17 Insert simply the city and state or country, e.g., "Paris, France", of the inventor's residence, not citizenship. No street address or postal code is required on this line.

line 18 Insert the inventor's citizenship. The statement of citizenship (or subject of) is a statutory requirement (35 USC §115). Simply the name of the country of citizenship, e.g., "Japan" is sufficient.

line 19 Insert the inventor's mailing address. The purpose of requiring the post office address is to enable the Patent Office to communicate directly with the inventor if desired, such as in the case of death of the U.S. attorney. It should be the address where the inventor customarily receives his (or her) mail and should include the postal code. If applicable it can be the inventor's business address or address at place of employment.

Applicants are reminded that the U.S. Patent and Trademark Office has very strict requirements as to proper execution of an application. The applicant should make sure that he reviews the declaration, prior to signing to make sure the declaration properly identifies the application and all relevant information; and should review the specification and claims (including drawings, if any) before signing the declaration. Failure to do so will require the filing of a supplemental declaration --- 37 CFR §1.67(c).

Any handwritten changes to the specification, claims or drawings must be in ink personally by all of the inventors prior to signing the declaration and the adjacent left margin must be initialed and dated by all of the inventors, e.g., "JBJ 6-9-91".

Please let us know if there are any questions regarding proper completion of this form. Thank you.

An assignment, a separate document requiring separate signature and dating may be enclosed. Please look for it and sign and date it in the same manner as in lines 15 and 16 above.

## STEVENS, DAVIS, MILLER &amp; MOSHER, L.L.P.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application or any patent issuing thereon.

## PAGE 2 OF U.S.A. DECLARATION FORM

13a	Typewritten Full Name of Sole or First Inventor	<u>Hideki</u>	Given Name	Middle Name	<u>KANEMOTO</u>	Family Name	
14a	Inventor's Signature	<u>7 hideki Kanemoto</u>					
15a	Date of Signature	<u>June</u>	Month	<u>4</u>	Day	<u>2001</u>	Year
16a	Residence	<u>Yokosuka-shi</u>	City	<u>Kanagawa</u>	State or Province	<u>JPX</u>	Country
17a	Citizenship	<u>JAPAN</u>					
18a	Post Office Address (Insert complete mailing address, including country)	<u>6-2-801, Hikari no Oka, Yokosuka-shi, Kanagawa 239-0847 JAPAN</u>					
13b	Typewritten Full Name of Sole or Second Inventor	<u>Osamu</u>	Given Name	Middle Name	<u>KATO</u>	Family Name	
14b	Inventor's Signature	<u>Osamu</u>					
15b	Date of Signature	<u>June</u>	Month	<u>4</u>	Day	<u>2001</u>	Year
16b	Residence	<u>Yokosuka-shi</u>	City	<u>Kanagawa</u>	State or Province	<u>JPX</u>	Country
17b	Citizenship	<u>JAPAN</u>					
18b	Post Office Address (Insert complete mailing address, including country)	<u>5-45-G302, Shonantakatori, Yokosuka-shi, Kanagawa 237-0066 JAPAN</u>					
13c	Typewritten Full Name of Sole or First Inventor	Given Name	Middle Name	Family Name			
15c	Inventor's Signature						
16c	Date of Signature	Month	Day	Year			
17c	Residence	City	State or Province		Country		
18c	Citizenship						
19c	Post Office Address (Insert complete mailing address, including country)						
14d	Typewritten Full Name of Sole or First Inventor	Given Name	Middle Name	Family Name			
15d	Inventor's Signature						
16d	Date of Signature	Month	Day	Year			
17d	Residence	City	State or Province		Country		
18d	Citizenship						
19d	Post Office Address (Insert complete mailing address, including country)						

\*Note to Inventor: Please sign name on line 15 exactly as it appears in line 14 and insert the actual date of signing on line 16. If there are more than four inventors, please add a copy of this page for identification and signatures for the additional inventors.